

a surface, the damage avoidance system **102** may determine that the risk of damage to the portable device **100** upon impact will likely exceed a damage threshold. If the expected risk of damage exceeds the damage threshold, the damage avoidance system **102** activates the protection system **106**, described below, which takes steps to reduce or substantially eliminate the damage to the device that would otherwise be caused at impact with the surface.

[0034] In addition to determining whether a risk of damage exceeds a damage threshold, the damage avoidance system **102** may utilize measurements from the safety monitoring system **104** (e.g., distance, velocity, acceleration) to calculate and/or predict a time remaining until impact with the surface. The time remaining until impact may be used by the protection system **106** to determine whether and/or when the reorientation element **118** and/or the protection element **120** should be activated such that the protection element **120** will first impact the surface. For example, if the measured orientation, motion and time until impact are such that the device will impact on a side containing the protection element **120**, the protection system **106** may not activate the reorientation element **118**. However, if the data measurements indicate that the portable device **100** will impact the surface with a side that does not include a protection element **120**, the protection system **106** may activate the reorientation element **118** at a specific time, based on the measurements, so that the portable device **100** is reoriented in a manner that a side with a protection element **120** will first impact the surface. In addition, if the protection element **120** is deployable (e.g., air bag, springs, thrusters), the protection system **106** may use the time remaining until impact to determine when to deploy the protection element **120**.

[0035] The protection system **106** may include any number of components that work to reduce or eliminate the detected risk of damage to the portable device **100**. For example, the protection system **106** may include an orientation detector **116**, a reorientation element **118** and a protection element **120**. The orientation detector **116** may be a standalone component or combination of components that are designed to detect the orientation of the portable device **100**. For example, devices such as accelerometers or tilt sensors could be used. As another example, orientation detector **116** may be a camera associated with the portable device **100**. For example, the camera can be located on the back surface of the portable device **100**. Images taken from the camera can be indicative of a ceiling, thus, the orientation of the portable device **100** may be that the front surface of the portable device **100** is facing toward the ground. The orientation of the portable device **100** with respect to other surfaces, for example a wall or a table, may then be extrapolated (determined) from such information. Detecting the orientation of the portable device **100** may provide the protection system **106** with information regarding the orientation of portable device **100** with respect to approaching surface(s). As described below, this information may help the protection system **106** determine what actions to take so that the portable device **100** will be in a desired orientation at impact with the surface.

[0036] The reorientation element **118** may be any number of elements that can alter the orientation of the portable device **100**. In general, the reorientation element **118** may produce a force, alter a physical property or otherwise create a change in and/or alter the orientation of the portable device **100** with respect to a surface. As discussed below with respect to FIGS. 7-10, examples of the reorientation element **118** may

be a gas expelled from a compressed gas cartridge, a rotational modifier, a moveable weight or other types of devices that can cause reorientation of the portable device **100**. An example reorientation technique using a moveable weight may be to relocate the position of the battery within portable device **100** to alter or create a rotation of portable device **100**. Yet another technique may be to utilize actuators to cause vibrations in the portable device **100** that cause portable device **100** to rotate in a desired direction. These techniques may be used alone or in conjunction with each other. Other techniques may be readily apparent to a person skilled in the relevant art. In one embodiment, reorientation element **118** and protection element **120** can be combined into a single element. For example, the same propulsion elements can be used to alter the device orientation (See FIG. 7) as well as cause a gentle or safe landing (See FIG. 3).

[0037] The protection element **120** may be any number of elements that help protect the portable device **100** from damage due to impact with a surface. In general, the protection element **120** acts to absorb the energy that would otherwise transfer to portable device **100** or to components inside the portable device **100** as a result of impact with a surface.

[0038] For example, the protection element **120** may be an energy-absorbing material, a material that allows the kinetic energy of portable device **100** to be dissipated over a greater time or area, a material that reduces the kinetic energy of portable device **100** or other appropriate materials. As discussed with respect to FIGS. 2-6, examples of the protection element **120** may be one or more of an airbag, a propulsion element, a spring, an impact absorbing structure and a reinforced edge, among others.

[0039] In addition to the elements described above, the portable device **100** may also contain a display **122**, an input device **124** (e.g., keypad) and a processor **126**. The processor **126** may be any number of devices that are commonly thought of as central processing units (CPUs) or any device that is capable of receiving an input, performing an operation on the input and producing an output. In general, the processor **126** may be the CPU of the portable device **100** or may be additional processing units that are used alone or in conjunction with the CPU in order to provide functionality to the portable device **100** and/or the damage avoidance system **102**.

[0040] It should be understood that display **122** and input device **124** are not required, but rather are used herein to help provide a frame of reference when discussing the orientation of portable device **100**. As used herein, the front surface **128** of the portable device **100** is the side that contains the display **122** and the input device **124**. The back surface (not shown) of the portable device **100** is the side opposite the front surface **128**. The top surface **130** is a side of the portable device **100** that perpendicularly extends between the front surface **128** and the back surface that is closer to the display **122** and further away from the input device **124**. The bottom surface **132** is the side opposite the top surface **130**. The left surface **134** is the side perpendicularly extending between the top surface **130** and the bottom surface **132** that is to the left of the display **122** as it faces a user. The right surface **136** is the side opposite the left surface **134**.

[0041] Although FIG. 1A illustrates that the damage avoidance system **102** is integral to the portable device **100**, in other embodiments one or more components of the damage avoidance system **102** may be removably attached to the portable device **100**. FIG. 1B illustrates a portable device **150** using a removably attachable damage avoidance system **152**. For